from
Delta Analysis.

"We provide traffic collision reconstruction consulting services in civil litigation. Our collision reconstruction specialists are experienced, successful, and fully accredited by ACTAR (Accreditation Commission for Traffic Accident Reconstruction)." Since 1993, Delta Analysis has served the Southern California legal profession & insurance community. http://www.deltacrash.com/index.html

Delta Analysis recently became one of the first firms in Southern California to acquire the new Crash Data Retrieval system from Vetronix Corporation.

C.D.R. Vehicle List **C.D.R. Article** **C.D.R. Links**

Delta Analysis is pleased to announce the acquisition of the new Vetronix Crash Data Retrieval (CDR) system. The CDR system has the capability to download specific crash data from the airbag module of selected GM vehicles. Similar to a commercial airliner's flight-data recorder or "black box," GM has only recently made crash data recovery tools available to researchers and investigators.

Since 1990, over six million GM vehicles have been equipped with the capacity to record at least some crash data from a vehicle's airbag deployment sensor. This information may be available even if the airbag does not deploy (a "near-deployment event"). Depending on the particular GM vehicle, the following crash data may be available:

- Vehicle speed (in five, one-second intervals preceding impact)
- Engine speed (in five, one-second intervals preceding impact)
- Brake status (in five, one-second intervals preceding impact)
- Throttle position (in five, one-second intervals preceding impact)
- Driver's seat belt state (On/Off)
- Passenger's airbag enabled or disabled state (On/Off)
- Airbag Warning Lamp status (On/Off)
- Time from vehicle impact to airbag deployment
- Maximum delta-V for near-deployment event
- Delta-V vs. time for frontal airbag deployment event
- Time from vehicle impact to time of maximum delta-V
- Time between near-deploy and deploy event (if within 5 seconds)

Delta Analysis collision reconstructionists are trained by GM representatives & certified by Vetronix Corporation in the use of the Crash Data Retrieval system. Delta Analysis collision reconstructionists are also ACTAR-accredited. The charge for retrieving a GM vehicle's crash data, including travel time, is the flat rate fee of $300 per vehicle in Los Angeles and surrounding counties. To learn more, click on the CDR article and CDR Links, or call 888-81-CRASH.

Introduction

We've all heard or read about flight data recorders, those so-called "black boxes" that are equipped on commercial airliners. When an airplane crashes, the information recorded in a black box is invaluable for not only understanding how and why the airplane crashed, but also helps to prevent future airline disasters. Race cars are also equipped with similar event data recorders.

Traffic collision investigators certainly could use similar technology. Traditional investigative methods of measuring and documenting evidence such as tire marks, impact areas, final vehicle resting positions, driver and witness statements, and vehicle damage are essential in determining what happened. But the final conclusions are only as accurate as the information that's available. Often, at-scene investigators have only limited time and resources to collect evidence, sometimes in less-than-ideal conditions. And because traffic collisions happen so quickly, witness statements (if any) may or may not be accurate.

But what if crashed vehicles were equipped with a scaled-down version of a black box that an investigator had immediate access to? What if this information included a vehicle's impact speed, throttle position, driver seat belt status, and brake application, along with access to this data for up to five seconds prior to the collision? Objective data from an automotive event data recorder could provide tremendous assistance for investigators, and provide increased details and accuracy of a crash investigation. But this type of technology is considered too futuristic and not currently available. Or is it?

It turns out this technology isn't so new. Since 1990, General Motors (GM) has quietly equipped over six million vehicles with the capability to record at least some crash data from a vehicle's airbag deployment sensor, known as the Sensing and Diagnostic Module (SDM). Actually, all airbag-equipped vehicles have SDMs or crash analyzers; it's just that GM's crash analyzers record data that's retrievable. Previously, this recorded data was considered proprietary, and retrieving it required direct assistance from GM.

In 1998, however, GM contracted with Vetronix Corporation of Santa Barbara, California (www.vetronix.com), to commercially develop software and interface cables to allow investigators, researchers, and anyone else who is interested to download a vehicle's crash data directly to any laptop computer. Vetronix, a leading manufacturer of vehicle diagnostic equipment, calls this system the Crash Data Retrieval (CDR). The CDR system is the second generation of the original "Event Data Retrieval Unit" that Vetronix developed and produced in 1990 exclusively for GM's internal use.

In 1997, the National Transportation Safety Board (NTSB) recommended auto manufacturers work together with the National Highway Traffic Safety Administration (NHTSA) to gather information on traffic collisions using onboard crash recording devices. Researchers were anxious for this data to help better understand automobile crashes and injury causation. GM predicted this technology would provide "fresh insight into how drivers react to hazards and interact with their vehicles."

While other automakers have reportedly equipped their vehicles with recordable airbag modules, GM is currently the only automaker that makes crash data and data recovery tools available to researchers and investigators. Most automakers are reluctant to release this capability for fear of how the information will be used in court and the possibility of increased lawsuits. GM's belief is the potential for improvements in auto safety outweigh any possible increase in litigation. Vetronix CDR circuitry also has the capability to download data from vehicles other than GM, and all that's required is for automakers to release the computer code.

How It Works

The SDM is basically the airbag "brain" that has a small amount of memory. Within milliseconds of a collision, a vehicle's SDM senses the crash severity and determines whether to deploy the airbags. Crash severity is measured by the vehicle's loss of velocity over time, known as "delta-V." The airbag deployment signal is also a signal to store data in the module. Once an airbag is deployed, the deployment record is permanently written. The data cannot be erased, altered or cleared, even if the battery is disconnected, the SDM becomes unplugged due to the force of the collision, or from emergency workers and investigative personnel. Once the airbags are deployed, the SDM must be replaced if the vehicle is repaired.

Newer GM airbag modules have has the added capability of recording crash data even when a vehicle's airbag doesn't deploy. The SDM is able to do this because there are two memory slots: one to record an airbag deployment event, and the other to temporarily record an airbag near-deployment event. A near-deployment event is when a vehicle sustains an impact that "wakes up" the airbag module, known as "algorithm enable," but the SDM determines the impact is not severe enough to deploy the airbags. Once written, a near-deployment record is cleared after 250 ignition cycles (equivalent to about 60 days of driving), or the record is overwritten by a new impact if it is greater than the previously stored near-deployment record.

What It Measures

Current CDR system software covers selected GM vehicles back to 1996, and Vetronix will periodically release future software updates to include GM vehicles back to 1990. All GM airbag modules do not record the same data, as it depends on the particular vehicle's electronic system.

Beginning with the 1994 model year, GM airbag sensors record 11 categories of information including airbag warning light status (dash light), driver's seatbelt switch circuit (buckled or unbuckled), passenger front airbag suppression switch status, ignition

cycle count at event time, time from vehicle impact to airbag deployment, any system malfunctions, and vehicle velocity change.

Advanced features were added to approximately 80% of 1999 GM models to also record vehicle speed, brake application, throttle position, and engine RPM in one-second intervals prior to a deployment or near-deployment event. Using a "continuous loop" system, this enhanced SDM records data taken during the five seconds preceding impact. This means an investigator can track a driver's reaction and vehicle speed in the five seconds leading up to a crash, and learn when the driver "gets off the throttle" and "gets on the brakes." GM calls this system the "Advanced Event Data Recorder." By 2004, GM plans to equip all of their North American cars, light trucks, and sport-utility vehicles with this capability.

There are two easy ways to access the SDM data. If the battery is connected and the vehicle is under power, simply plug the supplied cable into the 16-pin diagnostic connector, or "ODM II port," located within 12 inches of the steering column. The download takes only a few seconds. If the vehicle cannot be powered-up, the cable can be plugged directly into the SDM, usually located underneath the front seats on the vehicle. The CDR system software lists the SDM's exact location for every equipped GM vehicle.

Accuracy

At the first Vetronix CDR system operator training course held in June 2000, major topics included the accuracy and validation of the captured data in a vehicle's SDM, and how this information is then downloaded with the CDR system software and cables. General Motors safety engineer Don Floyd was the principal instructor of the course, as he is also the GM project manager for the CDR. Using a series of controlled vehicle crash tests and laboratory simulations, Floyd discussed how GM validated the accuracy of the CDR's recorded crash data. In extensive testing, GM found the CDR's error rate was consistently within 10% of a vehicle's actual velocity change. Floyd stressed the CDR system and software only retrieves and downloads data from the airbag-sensing module, as it is GM that determines what information is actually stored in the airbag module.

NHTSA has also conducted independent crash tests and will soon publish validation test results, possibly in January of 2001. Chip Chidester from NHTSA's Special Crash Investigation program was also a course presenter, and it is Chidester's team that heads his agency's CDR system testing. Chidester called the CDR's results "very reliable." In addition, Chidester discussed a paper he co-wrote that was presented at the NTSB-sponsored International Symposium on Transportation Recorders regarding the operation and testing of GM's sensing and diagnostic module as an event data recorder. The researchers found the SDM's test results were within defined error limits.

Trooper Ed O'hara from the Massachusetts State Police discussed an on-going statewide study on his department's use of the CDR system. In actual, real-world traffic accidents

involving GM vehicles, collision reconstructionists first determined the vehicle impact speeds using traditional methods, and then the CDR system was employed to compare the two results. O'hara said of the several cases they've had, the CDR vehicle speeds were very close to the vehicle speeds calculated by department reconstructionists.

GM's Floyd said the Insurance Institute for Highway Safety also started using this data recovery equipment in the dozens of crash tests they conduct each year, and Floyd anticipates the IIHS will soon begin reporting the validation results.

CDR Uses

From General Motors' point of view, onboard event data recorders will improve automotive safety through better real-world crash data. This data will also help determine if the automaker's vehicles performed as intended in alleged defect cases such as unintended vehicle acceleration or inadvertent airbag deployment. For investigators and collision reconstructionists, event data recorders have the potential to increase the accuracy of an investigation, provide more detailed and objective conclusions, and potentially reduce the time and costs of reconstructing a traffic collision.

Recorded crash data can also assist investigators in determining the cause or causes of a collision. For example, two cars crash at an intersection with posted four-way stop signs. Both drivers claim to have stopped, and they blame each other. With no witnesses, determining who ran the stop sign can be difficult. But by downloading an onboard, event data recorder, the investigator can track the speed and braking status of the vehicle in five, one-second intervals leading up to the collision, and discover who really stopped.

For civil use, vehicle event data recorders can help reduce fraudulent or exaggerated insurance claims. Such information can also help answer the frequent question of whether an occupant's seatbelt was buckled and stayed buckled in a collision, especially in seatbelt cases where physical evidence is not present or inconclusive.

With over 18,000 tow-away crashes occurring every year in the United States, onboard event data recorders could greatly enhance the quantity and quality of real-world crash test information that's collected in government files. This added information will assist researchers in studying driver behavior, how occupants interact with their vehicles, and how injuries are caused, potentially reducing highway fatalities and injuries.

Limitations

As with airbag deployment, a vehicle's SDM senses accelerations involving frontal impacts only, or impacts that significantly reduces a vehicle's forward motion. With crash and pre-crash data, if a vehicle begins sliding sideways prior to impact, only speed in the

vehicle's longitudinal (front/back) direction will be recorded. Thus, a car may be sliding sideways at a considerably higher speed than indicated in the SDM. Fortunately, by reviewing physical evidence such as tire marks, along with the CDR's five-second pre-crash graph chart, the vehicle's movement and speed change can be tracked and accounted for.

The SDM is currently not equipped with a date or time stamp, so the only indication of when a deployment or near-deployment event occurred is the number of ignition cycles between the actual event and the time of investigation. The CDR system does not read side-impact airbag modules. Also, the system hasn't been in public use long enough to be legally challenged. As with radar/laser speed measuring devices and preliminary alcohol screening devices, the underlying airbag module technology and CDR software must yet qualify as reliable and accurate inside the courtroom.

There are also "Big Brother-like" privacy issues including what law enforcement or insurance companies will do with this information, who actually owns this information (the vehicle owner) and who has the right to access it. The American Civil Liberties Union commented about this "in-car surveillance system" on their web site: "The loss of personal civil liberties always begins with the best intentions of our government." There are concerns future event data recorders may to equipped Global Positioning Systems to record where a vehicle has been driven. But unlike the flight data recorder found on airplanes, GM's airbag module is not a voice recorder and the system does not store a driver's steering input or wheel angle.

Conclusion

At the Vetronix training course, Trooper O'hara reminded the audience that the CDR system is not a substitute or replacement for conventional accident investigation and reconstruction methods. It's merely another tool to assist the investigator in learning the facts and increase accuracy. "We can't rely solely on technology," O'hara said, adding, "but the way I see it, it's the DNA of motor vehicle accidents."

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Timothy Staab is a Corporal with the Glendora, California, Police Department. He is an ACTAR-accredited collision reconstructionist and past contributor to LAW &ORDER magazine. He may be reached at www.deltacrash.com or 888-81-CRASH.